

WE CLAIM:

1. A device for positioning on a shelf of a multi-cabinet data storage cabinet in a mass storage system, comprising:

5        a first interface providing a communication link with a data path to a control device external to the apparatus;

      a second interface providing a communication link with a cabinet bus contained in the cabinet; and

      a processor for creating and at least periodically  
10 broadcasting environmental messages comprising status information for the device over the cabinet bus via the second interface and for collecting environmental messages broadcast by other ones of the devices over the cabinet bus and providing at least a portion the collected environmental  
15 messages to the control device over the communication link via the first interface.

2. The device of Claim 1, further including memory storing a reporting group identifier indicating a reporting group assignment for the device, wherein the second  
20 interface is adapted to determine ones of the environmental messages broadcast on the cabinet bus broadcast by other devices in the assigned reporting group and to transmit the determined ones to the processor.

3. The apparatus of Claim 2, wherein the  
25 environmental messages broadcast by the processor include the reporting group identifier.

4. The apparatus of Claim 2, wherein the environmental messages broadcast by the processor include an

identifier for the cabinet and physical location information for the shelf in the cabinet.

5. The apparatus of Claim 4, wherein the communication link comprises a fibre channel loop.

5 6. The apparatus of Claim 5, wherein the device is an array controller.

7. The apparatus of Claim 1, wherein the device is positioned outside the cabinet.

10 8. The apparatus of Claim 1, wherein the broadcast environmental messages comprise SCSI-3 Enclosure (SES) data.

9. A mass storage system for providing unified system management, comprising:

15 a first reporting group comprising an enclosure having an enclosure processor for generating and transmitting an environmental message for the first reporting group enclosure;

20 a second reporting group comprising an enclosure having an enclosure processor for generating and transmitting an environmental message for the second reporting group enclosure; and

25 a bus communicatively linked to the first reporting group enclosure and to the second reporting group enclosure for carrying the environmental messages, wherein the environmental messages includes information for identifying whether the environmental message was sent from an enclosure in the first or second reporting group and information for identifying a physical location of the sending enclosure.

10. The system of Claim 9, further including a cabinet having shelves for positioning the enclosures of the first and second reporting groups and for housing the bus.

11. The system of Claim 10, further including an  
5 additional cabinet comprising shelves for positioning an additional enclosure of the first or the second reporting group and an additional bus linked to the additional enclosure for carrying environmental messages to and from the additional enclosure to and from the enclosures in the  
10 other cabinet.

12. The system of Claim 11, further including a cabinet communication network linked to each of the cabinets for transmitting the environmental messages between the cabinets.

15 13. The system of Claim 11, wherein each of the cabinets includes a cabinet processor linked to the cabinet communication network and the busses adapted to receive the environmental messages, to determine based on the reporting group identifying information whether the enclosures in the  
20 particular cabinet are in a matching reporting group, and if a match is determined, transmitting the received environmental message on the bus.

14. The system of Claim 9, wherein the enclosure processors are further adapted to receive ones of the environmental messages on the linked bus and to store in memory the received ones determined based on the reporting group identifying information to have been sent from the reporting group to which they belong.  
25

15. The system of Claim 9, further including a first data loop linked to the first reporting group and a second data loop linked to the second reporting group, wherein the enclosure processors are configured for transmitting  
5 environmental data for the first and second reporting groups, respectively, and to receive command data over the first and second data loops, respectively.

16. The system of Claim 15, wherein a host device is linked to the first and second data loops for receiving the  
10 environmental data and for providing the command data.

17. The system of Claim 15, wherein a first host device is linked to the first data loop for receiving the environmental data from the first reporting group and for providing the command data to the first reporting group and  
15 a second host device is linked to the second data loop for receiving the environmental data from the second reporting group and for providing the command data to the second reporting group.

18. The system of Claim 17, wherein a management tool  
20 is linked to the first and second host devices for receiving the environmental data from the first and second reporting groups and for providing the command data to the first and second reporting groups.

19. A data storage system, comprising:  
25 a plurality of cabinets each having a plurality of shelves for receiving and linking computing devices and a cabinet bus linked to the shelves for communicatively linking computing devices inserted in the shelves;

a first set of enclosure devices assigned to a first reporting group positioned on the shelves in the cabinets and linked to at least one of the cabinet busses; and

5       a second set of enclosure devices assigned to a second reporting group positioned on the shelves in the cabinets and linked to at least one of the cabinet busses;

10      wherein each of the enclosure devices in the first and second reporting group includes an enclosure processor adapted for transmitting an enclosure environmental message over the linked cabinet bus.

20.     The system of Claim 19, wherein the environmental messages from the enclosure devices in the first and second reporting groups are transmitted substantially concurrently.

21.     The system of Claim 19, wherein at least one of 15 the enclosure devices in the first reporting group and at least one of the enclosure devices in the second reporting group are located in one of the cabinets.

22.     The system of Claim 19, wherein a first subset of 20 the enclosure devices in the first set are positioned in a first one of the cabinets and a second subset of the enclosure devices in the first set are positioned in a second one of the cabinets.

23.     The system of Claim 19, further including a first data loop communicatively linking each of the enclosure devices in the first reporting group and a second data loop communicatively linking each of the enclosure devices in the second reporting group, wherein the first and second data loops are distinct data paths from each other and from the cabinet busses.

24. The system of Claim 23, further including a first host device linked to the first data loop and a second host device linked to the second data loop for communicating command sets to each of the reporting groups and monitoring  
5 each of the reporting groups.

25. The system of Claim 23, further including a host device linked to the first and second data loops for monitoring and controlling the first and second reporting groups with command sets transmitted over the first and  
10 second data loops.

26. The system of Claim 19, further including a cabinet network linked to each of the cabinets for transferring the environmental messages between cabinet busses in differing ones of the cabinets.

15 27. The system of Claim 26, wherein the enclosure environmental messages include information identifying for a sending one of the enclosure devices an assigned reporting group, one of the cabinets housing the sending enclosure device, and one of the shelves containing the sending  
20 enclosure device.

28. The system of Claim 26, further including cabinet processors between the cabinet network and each of the cabinet busses, wherein the cabinet processors broadcast on the adjacent cabinet bus ones of the environmental messages  
25 on the cabinet network based on the assigned reporting group information relating to ones of the reporting groups housed in the cabinet linked to the particular cabinet processor.

29. The system of Claim 26, wherein the enclosure  
processors are adapted to monitor the enclosure  
environmental messages on the linked cabinet bus and to  
store environmental information from ones of the messages  
5 which the assigned reporting group matches their reporting  
group.

30. The system of Claim 19, wherein one of the  
enclosure devices in each of the first and second reporting  
groups is designated as a primary reporting device, the  
10 primary reporting device being configured to receive command  
sets from control devices via a data path, to transfer the  
command sets to other ones of the enclosure devices  
identified in the command sets, and to provide collected  
environmental information to the control devices via the  
15 data path.